

Claims

WHAT IS CLAIMED IS :

1. In a spindle motor for a hard disk drive (HDD), an aero and fluid hybrid dynamic pressure bearing of a spindle motor, comprising: an aero dynamic pressure bearing which is formed in a structure that there are provided a disk shaped bearing assembly, and a certain pore surrounding the bearing assembly and which includes a plurality of grooves and forms an air layer having a certain strength so that an air flow supports a load between a hub and the bearing assembly after the hub is operated; and a fluid dynamic pressure bearing which is formed in a structure that a plurality of grooves are formed in at least one surface among a spindle shaft, a sleeve surrounding the spindle shaft, and a thrust plate and which has a pore formed between the spindle shaft and the sleeve for rotatably supporting the hub and filled with a certain fluid.
- 15 2. The bearing of claim 1, wherein a groove is formed in at least one among an upper horizontal surface of the bearing assembly, a lower horizontal surface of the bearing assembly, and an outer surface of the bearing assembly.
- 20 3. The bearing of claim 1, wherein said fluid has a certain viscosity and forms a discharging path of a static electricity.
4. The bearing of claim 1, wherein said hub has a groove in at least one

among a lower portion of the hub, an inner surface of the hub and an inner surface of the bushing thrust.

5. The bearing of claim 1, wherein said spindle shaft includes a spindle
shaft formed in a spherical shape, a semi-circular shape, a conical shape or a
cylindrical shape.

6. The bearing of claim 1, wherein in said spindle shaft, a bearing
assembly of the aero dynamic pressure bearing does not make a mechanical
10 friction with a hub which is an opponent element when the hub is operated or is
stopped.

7. The bearing of claim 1, wherein said fluid dynamic pressure bearing
is rotated with respect to a hub shaft which passes through the interior of the
15 same in a vertical direction.

8. The bearing of claim 1, wherein said fluid dynamic pressure bearing
forms a fluid dynamic pressure between the fluid dynamic pressure bearing
assembly and the spindle shaft.

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9. In a spindle motor for a hard disk drive which includes a base which
forms a lower construction, a hub which is rotatably installed in an upper

portion of the base and fixes a platter in an upper surface, and has a permanent magnet in an inner lower surface, and a stator which has a plurality of teeth having a coil wound thereon and protruded in a direction of an outer surface for thereby forming a radial construction, a fluid and air hybrid dynamic pressure bearing, comprising:

an aero dynamic pressure bearing which is formed in a structure that there are provided a disk shaped bearing assembly, and a certain pore surrounding the bearing assembly and which includes a plurality of grooves and forms an air layer having a certain strength so that an air flow supports a load
5 between a hub and the bearing assembly after the hub is operated;

a fluid dynamic pressure bearing which is formed in a structure that a plurality of grooves are formed in at least one surface among a spindle shaft, a sleeve surrounding the spindle shaft, and a thrust plate and which has a pore formed between the spindle shaft and the sleeve for rotatably supporting the hub
10 and filled with a certain fluid; and

a bushing thrust provided between the fluid dynamic pressure bearing, a ring shaped permanent magnet, a back yoke which supports the permanent magnet, a bearing assembly of the aero dynamic pressure bearing and the stator.

20 10. The bearing of claim 9, wherein said hub includes a fluid dynamic pressure bearing in the interior of the same and is rotatably installed in an upper portion of the base.

11. The bearing of claim 9, wherein said groove is provided by at least one.

5 12. The bearing of claim 9, wherein said fluid has a certain viscosity and forms a discharging path of a static electricity.

10 13. The bearing of claim 9, wherein said hub has a groove in at least one among a lower portion of the hub, an inner surface of the hub and an inner surface of the bushing thrust.

14. The bearing of claim 9, wherein said spindle shaft includes a spindle shaft formed in a spherical shape, a semi-circular shape, a conical shape or a cylindrical shape.

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15. The bearing of claim 9, wherein said fluid dynamic pressure bearing is rotated with respect to the spindle shaft positioned in the interior.

20 16. The bearing of claim 9, wherein in said fluid dynamic pressure bearing, a fluid dynamic pressure is formed between the sleeve and the spindle shaft.

17. The bearing of claim 9, wherein the center of the fluid dynamic pressure bearing is supported in a radial direction and a thrust direction.

18. The bearing of claim 9, wherein said aero dynamic pressure bearing
5 is installed in a space formed by the aero dynamic pressure bearing assembly
and the hub for thereby forming an aero dynamic pressure between the hub and
the aero dynamic pressure bearing assembly when the hub is rotated.

19. The bearing of claim 9, wherein said aero dynamic pressure bearing
10 is installed in A lower portion of the hub distanced from the fluid dynamic
pressure bearing in an inner surface for thereby receiving a thrust and radial
direction load based on a non-contact method.

20. In a spindle motor for a hard disk drive which includes a base which
15 forms a lower construction, a hub which is rotatably installed in an upper
portion of the base and fixes a platter in an upper surface, and has a permanent
magnet in an inner lower surface, and a stator which has a plurality of teeth
having a coil wound thereon and protruded in a direction of an outer surface for
thereby forming a radial construction, a fluid and air hybrid dynamic pressure
20 bearing, comprising:

an aero dynamic pressure bearing which is formed in a structure that
there are provided a disk shaped bearing assembly, and a certain pore

surrounding the bearing assembly and which includes a plurality of grooves and forms an air layer having a certain strength so that an air flow supports a load between a hub and the bearing assembly after the hub is operated;

- a fluid dynamic pressure bearing which is implemented in a structure
- 5 that a plurality of grooves are formed in at least one surface in the spindle shaft, a sleeve surrounding the same, and a thrust plate, and a certain fluid for a discharging path of a static electricity is filled in a pore formed between the spindle shaft and the sleeve for rotatably supporting the hub and forming a fluid dynamic pressure between the spindle shaft; and
- 10 a bushing thrust which is implemented in a structure that the fluid dynamic pressure bearing is fixed with respect to the spindle shaft formed in an upper portion of the hub and in which the fluid dynamic pressure bearing is fixed about the hub shaft which passes through one end formed in a vertical direction of the interior, said busing thrust being provided between the ring shaped permanent magnet, a back yoke supporting the permanent magnet, a bearing assembly of the aero dynamic pressure bearing and the stator.

21. The bearing of claim 20, wherein said groove is provided by more than at least one.

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22. The bearing of claim 20, wherein said hub has a groove in at least one among a lower portion of the hub, an inner surface of the hub and an inner

surface of the bushing thrust.

23. The bearing of claim 20, wherein said spindle shaft includes a spindle shaft formed in a spherical shape, a semi-circular shape, a conical shape
5 or a cylindrical shape.

24. The bearing of claim 20, wherein said aero dynamic pressure bearing is installed in a space formed by the aero dynamic pressure bearing assembly and the hub, and an aero dynamic pressure is formed between the hub
10 and the aero dynamic pressure bearing assembly when the hub is rotated.

25. The bearing of claim 20, wherein said aero dynamic pressure bearing is installed in a lower portion of the hub distanced from the fluid dynamic pressure bearing in an inner surface and receives a thrust and radial
15 direction load based on a non-contact method.

26. In a spindle motor for a hard disk drive which includes a base which forms a lower construction, a hub which is rotatably installed in an upper portion of the base and fixes a platter in an upper surface, and has a permanent
20 magnet in an inner lower surface, and a stator which has a plurality of teeth having a coil wound thereon and protruded in a direction of an outer surface for thereby forming a radial construction, a fluid and air hybrid dynamic pressure

bearing, comprising:

an aero dynamic pressure bearing which is formed in a structure that there are provided a disk shaped bearing assembly, and a certain pore surrounding the bearing assembly and which includes a plurality of grooves and

5 forms an air layer having a certain strength so that an air flow supports a load between a hub and the bearing assembly after the hub is operated;

a fluid dynamic pressure bearing which is implemented in a structure that a plurality of grooves are formed in at least one surface in the spindle shaft, a sleeve surrounding the same, and a thrust plate, and a certain fluid for a

10 discharging path of a static electricity is filled in a pore formed between the spindle shaft and the sleeve for rotatably supporting the hub and forming a fluid dynamic pressure between the spindle shaft; and

a bushing thrust which is implemented in a structure that the fluid dynamic pressure bearing is fixed with respect to the spindle shaft formed in an

15 upper portion of the hub and in which the fluid dynamic pressure bearing is fixed about the hub shaft which passes through one end formed in a vertical direction of the interior, said busing thrust being provided between the ring shaped permanent magnet, a back yoke supporting the permanent magnet, a bearing assembly of the aero dynamic pressure bearing and the stator, wherein

20 the sleeve is fixed to the hub, and the spindle shaft is fixed to the bearing assembly, and the sleeve is rotated together with the hub.

27. In a spindle motor for a hard disk drive which includes a base which forms a lower construction, a hub which is rotatably installed in an upper portion of the base and fixes a platter in an upper surface, and has a permanent magnet in an inner lower surface, and a stator which has a plurality of teeth having a coil wound thereon and protruded in a direction of an outer surface for thereby forming a radial construction, a fluid and air hybrid dynamic pressure bearing, comprising:
- an aero dynamic pressure bearing which is formed in a structure that
- 10 there are provided a disk shaped bearing assembly, and a certain pore surrounding the bearing assembly and which includes a plurality of grooves and forms an air layer having a certain strength so that an air flow supports a load between a hub and the bearing assembly after the hub is operated;
- a fluid dynamic pressure bearing which is implemented in a structure
- 15 that a plurality of grooves are formed in at least one surface in the spindle shaft, a sleeve surrounding the same, and a thrust plate, and a certain fluid for a discharging path of a static electricity is filled in a pore formed between the spindle shaft and the sleeve for rotatably supporting the hub and forming a fluid dynamic pressure between the spindle shaft; and
- 20 a bushing thrust which is implemented in a structure that the fluid dynamic pressure bearing is fixed with respect to the spindle shaft formed in an upper portion of the hub and in which the fluid dynamic pressure bearing is

fixed about the hub shaft which passes through one end formed in a vertical direction of the interior, said busing thrust being provided between the ring shaped permanent magnet, a back yoke supporting the permanent magnet, a bearing assembly of the aero dynamic pressure bearing and the stator, wherein
5 the sleeve is fixed to the hub, and the spindle shaft which is downwardly extended is fixed to the bearing assembly, and the sleeve is rotated together with the hub.

28. In a spindle motor for a hard disk drive which includes a base which
10 forms a lower construction, a hub which is rotatably installed in an upper portion of the base and fixes a platter in an upper surface, and has a permanent magnet in an inner lower surface, and a stator which has a plurality of teeth having a coil wound thereon and protruded in a direction of an outer surface for thereby forming a radial construction, a fluid and air hybrid dynamic pressure
15 bearing, comprising:

an aero dynamic pressure bearing which is formed in a structure that there are provided a disk shaped bearing assembly, and a certain pore surrounding the bearing assembly and which includes a plurality of grooves and forms an air layer having a certain strength so that an air flow supports a load
20 between a hub and the bearing assembly after the hub is operated;

a fluid dynamic pressure bearing which is implemented in a structure that a plurality of grooves are formed in at least one surface in the spindle shaft,

a sleeve surrounding the same, and a thrust plate, and a certain fluid for a discharging path of a static electricity is filled in a pore formed between the spindle shaft and the sleeve for rotatably supporting the hub and forming a fluid dynamic pressure between the spindle shaft; and

- 5 a bushing thrust which is implemented in a structure that the fluid dynamic pressure bearing is fixed with respect to the spindle shaft formed in an upper portion of the hub and in which the fluid dynamic pressure bearing is fixed about the hub shaft which passes through one end formed in a vertical direction of the interior, said busing thrust being provided between the ring
- 10 shaped permanent magnet, a back yoke supporting the permanent magnet, a bearing assembly of the aero dynamic pressure bearing and the stator, wherein the sleeve is fixed to the hub, and the spindle shaft which is upwardly and downwardly extended is fixed to the bearing assembly, and the sleeve is rotated together with the hub.

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29. In a spindle motor for a hard disk drive which includes a base which forms a lower construction, a hub which is rotatably installed in an upper portion of the base and fixes a platter in an upper surface, and has a permanent magnet in an inner lower surface, and a stator which has a plurality of teeth having a coil wound thereon and protruded in a direction of an outer surface for thereby forming a radial construction, a fluid and air hybrid dynamic pressure bearing, comprising:

an aero dynamic pressure bearing which is formed in a structure that there are provided a disk shaped bearing assembly, and a certain pore surrounding the bearing assembly and which includes a plurality of grooves and forms an air layer having a certain strength so that an air flow supports a load

5 between a hub and the bearing assembly after the hub is operated;

a fluid dynamic pressure bearing which is implemented in a structure that a plurality of grooves are formed in at least one surface in the spindle shaft, a sleeve surrounding the same, and a thrust plate, and a certain fluid for a discharging path of a static electricity is filled in a pore formed between the 10 spindle shaft and the sleeve for rotatably supporting the hub and forming a fluid dynamic pressure between the spindle shaft; and

a structure that the fluid dynamic pressure bearing is fixed with respect to the spindle shaft formed in an upper portion of the hub, and the fluid dynamic pressure bearing is fixed about the hub shaft which passes through one end 15 formed in a vertical direction of the interior, and there are provided a ring shaped permanent magnet, and a back yoke which support the permanent magnet, wherein the sleeve is fixed to the hub, and the spindle shaft which is upwardly and downwardly extended is fixed to the bearing assembly, and the sleeve is rotated together with the hub.

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30. In a spindle motor for a hard disk drive which includes a base which forms a lower construction, a hub which is rotatably installed in an upper

portion of the base and fixes a platter in an upper surface, and has a permanent magnet in an inner lower surface, and a stator which has a plurality of teeth having a coil wound thereon and protruded in a direction of an outer surface for thereby forming a radial construction, a fluid and air hybrid dynamic pressure

5 bearing, comprising:

an aero dynamic pressure bearing which is formed in a structure that there are provided a disk shaped bearing assembly, and a certain pore surrounding the bearing assembly and which includes a plurality of grooves and forms an air layer having a certain strength so that an air flow supports a load

10 between a hub and the bearing assembly after the hub is operated;

a fluid dynamic pressure bearing which is implemented in a structure that a plurality of grooves are formed in at least one surface in the spindle shaft, a sleeve surrounding the same, and a thrust plate, and a certain fluid for a discharging path of a static electricity is filled in a pore formed between the 15 spindle shaft and the sleeve for rotatably supporting the hub and forming a fluid dynamic pressure between the spindle shaft; and

a structure that the fluid dynamic pressure bearing is fixed with respect to the spindle shaft formed in an upper portion of the hub, and the fluid dynamic pressure bearing is fixed about the hub shaft which passes through one end 20 formed in a vertical direction of the interior, and there are provided a ring shaped permanent magnet, and a back yoke which support the permanent magnet, wherein the aero dynamic pressure bearing and the fluid dynamic pressure

bearing are assembled or disassembled.

31. In a spindle motor for a hard disk drive which includes a base which forms a lower construction, a hub which is rotatably installed in an upper portion of the base and fixes a platter in an upper surface, and has a permanent magnet in an inner lower surface, and a stator which has a plurality of teeth having a coil wound thereon and protruded in a direction of an outer surface for thereby forming a radial construction, a fluid and air hybrid dynamic pressure bearing, comprising :
 - 10 an aero dynamic pressure bearing which is formed in a structure that there are provided a disk shaped bearing assembly, and a certain pore surrounding the bearing assembly and which includes a plurality of grooves and forms an air layer having a certain strength so that an air flow supports a load between a hub and the bearing assembly after the hub is operated;
 - 15 a fluid dynamic pressure bearing which is implemented in a structure that a plurality of grooves are formed in at least one surface in the spindle shaft, a sleeve surrounding the same, and a thrust plate, and a certain fluid for a discharging path of a static electricity is filled in a pore formed between the spindle shaft and the sleeve for rotatably supporting the hub and forming a fluid dynamic pressure between the spindle shaft; and
 - 20 a bushing thrust which is implemented in a structure that the fluid dynamic pressure bearing is fixed with respect to the spindle shaft formed in an

upper portion of the hub and in which the fluid dynamic pressure bearing is fixed about the hub shaft which passes through one end formed in a vertical direction of the interior, said busing thrust being provided between the ring shaped permanent magnet, a back yoke supporting the permanent magnet, a
5 bearing assembly of the aero dynamic pressure bearing and the stator, wherein said hub is integrally formed with the aero dynamic pressure bearing, and the aero dynamic pressure bearing is fixed to the sleeve.

32. In a spindle motor for a hard disk drive which includes a base which
10 forms a lower construction, a hub which is rotatably installed in an upper portion of the base and fixes a platter in an upper surface, and has a permanent magnet in an inner lower surface, and a stator which has a plurality of teeth having a coil wound thereon and protruded in a direction of an outer surface for thereby forming a radial construction, a fluid and air hybrid dynamic pressure
15 bearing, comprising:

an aero dynamic pressure bearing which is formed in a structure that there are provided a disk shaped bearing assembly, and a certain pore surrounding the bearing assembly and which includes a plurality of grooves and forms an air layer having a certain strength so that an air flow supports a load
20 between a hub and the bearing assembly after the hub is operated;

a fluid dynamic pressure bearing which is implemented in a structure that a plurality of grooves are formed in at least one surface in the spindle shaft,

a sleeve surrounding the same, and a thrust plate, and a certain fluid for a discharging path of a static electricity is filled in a pore formed between the spindle shaft and the sleeve for rotatably supporting the hub and forming a fluid dynamic pressure between the spindle shaft; and

- 5 a bushing thrust which is implemented in a structure that the fluid dynamic pressure bearing is fixed with respect to the spindle shaft formed in an upper portion of the hub and in which the fluid dynamic pressure bearing is fixed about the hub shaft which passes through one end formed in a vertical direction of the interior, said busing thrust being provided between the ring
10 shaped permanent magnet, a back yoke supporting the permanent magnet, a bearing assembly of the aero dynamic pressure bearing and the stator, wherein said aero dynamic pressure bearing is separately assembled, and the aero dynamic pressure bearing is fixed to the sleeve.

- 15 33. In a bearing of a spindle motor for a hard disk drive which includes a base which forms a lower construction, a hub which is rotatably installed in an upper portion of the base and fixes a platter, and a stator in which a plurality of teeth each having a coil are protruded in a direction of an outer surface in a radial shape, a hybrid dynamic pressure bearing of a spindle motor, comprising:
20 an aero dynamic pressure bearing which includes a bearing assembly formed in a disk shape and forming an upper construction, and a support member which is integrally formed with a lower portion of the bearing assembly

and is compression-fixed to the base and which is installed in a space formed by the base and the hub;

- an aero dynamic pressure bearing which forms an air layer having a certain strength for supporting a load of an air flow between the hub and the
- 5 bearing assembly after the hub is operated, in such a manner that a groove is formed in at least one surface among an upper horizontal surface and a lower horizontal surface of the bearing assembly of the aero dynamic pressure bearing, a lower horizontal surface of the hub, an integral inner surface of the hub, and an inner surface of the bushing thrust; and
- 10 a fluid dynamic pressure bearing which obtains a static electricity path by filling a certain fluid such as an oil having a certain viscosity with respect to a static electricity generated in a peripheral portion of the hub and platter and which has an inner construction of a spherical shape, a semi-circular shape, a conical shape or a cylindrical shape, said fluid dynamic pressure bearing
- 15 supporting the center of the hub in the radial direction and thrust direction.

34. In a spindle motor for a hard disk drive which includes a base which forms a lower construction, a hub which is rotatably installed in an upper portion of the base and fixes a platter in an upper surface, and has a permanent magnet in an inner lower surface, and a stator which has a plurality of teeth having a coil wound thereon and protruded in a direction of an outer surface for thereby forming a radial construction, a fluid and air hybrid dynamic pressure

bearing, comprising:

- an aero dynamic pressure bearing which is formed in a structure that there are provided a disk shaped bearing assembly, and a certain pore surrounding the bearing assembly and which includes a plurality of grooves and
- 5 forms an air layer having a certain strength so that an air flow supports a load between a hub and the bearing assembly after the hub is operated;
- a fluid dynamic pressure bearing which is implemented in a structure that a plurality of grooves are formed in at least one surface among a spindle shaft, a sleeve surrounding the spindle shaft, and a thrust plate, wherein rotation
- 10 and support point are fixed at a center which passes through the interior in a vertical direction, and a fluid for a discharging path of a static electricity is filled in a port formed between the spindle shaft and the sleeve for rotatably supporting the hub and forming a fluid dynamic pressure between the spindle shaft; and
- 15 a bushing thrust which is implemented in a structure that the fluid dynamic pressure bearing is fixed with respect to the spindle shaft formed in an upper portion of the hub and in which the fluid dynamic pressure bearing is fixed about the hub shaft which passes through one end formed in a vertical direction of the interior, said busing thrust being provided between the ring
- 20 shaped permanent magnet, a back yoke supporting the permanent magnet, a bearing assembly of the aero dynamic pressure bearing and the stator.